RUBRICS

Systems Engineering Paper – 25 Points

Each team must submit a Systems Engineering Paper electronically in PDF. Your paper should discuss the Systems Engineering methods used to design and build your mining robot. The purpose of the systems engineering paper is to encourage the teams to use the systems engineering process while designing, building and testing their robot as opposed to writing a paper after the fact. All pertinent information required in the rubric must be in the body of the paper. A minimum score of 16 out of 20 possible points must be achieved to qualify to win in this category. In the case of a tie, the judges will choose the winning Systems Engineering Paper. The judges' decision is final. For reference, undergraduate course materials in NASA Systems Engineering, are available at www.spacese.spacegrant.org.

Scoring Rubric - Systems Engineering Paper	
Elements	Points
Content	There are 3 points for 3 elements
* Formatted professionally, clearly organized, correct grammar and spelling, size 12 font; single spaced, maximum of 20 pages not including the cover, table of contents, and source pages. Appendices are allowed, are limited to 5 pages, and should be referenced in the main body. Cover page must include: team name, title of paper, full names of all team members, university name, and faculty advisor's full name.	
* Title page must include the signature of the sponsoring faculty advisor and a statement that he/she has read and reviewed the paper prior to submission to NASA.	
* Purpose Statement must be included and related to the application of systems engineering to NASA's Robotic Mining Competition.	

Intrinsic Merit:	There are 8 points for 4 elements
* Cost budget (estimated costs vs. actual costs)	
* Design philosophy in the context of systems engineering; discuss what your team is optimizing in your design approach (light weight? automation? BP-1 capacity? Ice simulant, etc.)	
* Schedule of work from inception to arrival at competition	
* Major reviews: system requirements, preliminary design and critical design	

Technical Merit	There are 8 points for 8 elements. Up to 6 points may be awarded for exceptional work
* Concept of operations	
* System hierarchy	
* Interfaces	
* Requirements	

* Technical budgets (mass, power & data allocated to components vs. actual mass, power, & data usage)	related to systems engineering technical merit, for a total of 14 points.
* Trade-off assessments	
* Reliability	
* Verification of system meeting requirements	

Outreach Project Report – 20 Points

Each team must participate in an educational outreach project in their local community to engage students in STEM (Science, Technology, Engineering and Math). Outreach activities should capitalize on the excitement of NASA's discoveries to spark student interest and involvement in STEM. Outreach strategies may include lessons and classroom materials using emerging communications and educational technologies to promote STEM; hands-on science and engineering activities that draw on NASA's unique missions; and community demonstrations that have a hands-on component involving K-12 students. Teams are encouraged to connect with a diverse student population including women, minorities and persons with disabilities. Each team must submit a report of the Outreach Project electronically in PDF. A minimum score of 16 out of 20 possible points must be achieved to qualify to win in this category. In the case of a tie, the judges will choose the winning outreach project. The judges' decision is final.

Scoring Rubric - Outreach Project Report	
Elements	Points
Structure, Content and Intrinsic Merit:	There are 3 points for 3 elements
*Formatted professionally, clearly organized, correct grammar and spelling, size 12 font; single spaced, maximum of 5 pages not including the cover. Appendices are not allowed, however, a link in the body of the report to a multimedia site with additional photos or videos is allowed. Cover page must include: team name, title of paper, full names of all team members, university name and faculty advisor's full name.	
* Purpose for this outreach project, identify outreach recipient group(s).	
* Illustrations must appropriately demonstrate the outreach project.	

Educational Outreach Merit:	There are 10 points for 5 elements.
The report must effectively describe what the outreach activity(s) was.	
* The report must describe exactly how the Robotic Mining Competition team participated, including the number of team members present.	
* The report must reflect how the team thinks the outreach project inspired others to learn about robotics, engineering or Martian activities. The outreach must be STEM focused.	
* The report must demonstrate the quality of the outreach including how hands-on activities were used to engage the audience at their level of understanding.	
* The report must show statistics on the participants. How many children did you reach? What age range/grade-level? EACH EVENT NEEDS STATISTICS	

Additional points for exceptional work:	

* The report must clearly describe activities, processes, and milestones used to engage underserved and underrepresented populations.	There are 7 points available.
* The report must provide a summary of any feedback comments from each outreach event.	
* The report must clearly describe how Science, Technology, Engineering, and Mathematics (STEM) relates to the development of robotic mining.	
* The report must provide two illustrations that clearly demonstrate how Science, Technology, Engineering, and Mathematics (STEM) relates to the development of robotic mining.	

Slide Presentation and Demonstration – 20 Points

The Slide Presentation and Demonstration is an optional category in the overall competition. The presentation and demonstration must be no more than 20 minutes with an additional 5 minutes for questions and answers. It will be judged at the competition in front of an audience including NASA and private industry judges. The presentations must be submitted electronically in PDF and **MUST** present the slides turned in. Visual aids, such as videos and handouts, may be used during the presentation but videos must be presented using the team's own laptop. You may NOT update/modify your slide presentation and present it from your laptop. A minimum score of 16 out of 20 possible points must be achieved to qualify to win in this category. The content, formatting and illustration portion of the score will be judged prior to the live presentation and scored based on the presentation turned in. In case of a tie, the judges will choose the winning presentation. The judges' decision is final.

Scoring Rubric - Slide Presentation and Demonstration	
Elements	Points
Content, formatting, and illustrations::	There are 4 points for 4 elements
* Content includes a cover slide (with team name, presentation title, names of team members, university name, and faculty advisor's name). Also includes an introduction slide and referenced sources.	
* Formatting is readable and aesthetically pleasing with proper grammar and spelling.	
* Illustrations support the technical content	
* Illustrations show progression of the project and final design	

Technical Merit:	There are 5 points for 5 elements. Up to 2 additional points may be awarded for exceptional work related to technical merit, for a total of 7 points.
* Design Philosophy and Process	
* Design Alternative Analysis and Final Design	
* Mining functionality	
* Special features – highlight what makes the robot unique or innovative	
* Project Management	

Additional points for exceptional work:	There are 5 points for 5 elements. Up to 4 additional points may be awarded for an
* Handles slides and equipment professionally	
* Engages audience and infuses personality	

* Creative and inspirational	exceptional presentation, for a total of 9 points.
* Demonstrates Robot	
* Answers Questions	

Social Media and Public Engagement – 10 Points

Social Media and Public Engagement is an optional category in the overall competition. A minimum score of 7 out of 10 possible points must be achieved to qualify to win in this category. In the case of a tie, the judges will choose the winning team. The judges' decision is final.

Scoring Rubric - Social Media and Public Engagement	
Elements	Points
Social Presence:	3 points for 3 elements clearly, 2 points for 2 or less elements clearly and 1 - 0 points for 1 or 0 elements clearly demonstrated.
* Uses various social media platforms to engage the public in their participation in RMC introduction slide and referenced sources.	
* Engages with NASA and other robotic teams	
* Encourages other groups to engage in social media activities with their team	

Content	4 point for 4 elements exceptional, 3 points for 3 elements exceptional, 2 points for 2 or less elements clearly and 1 - 0 points for 1 or 0 elements clearly demonstrated.
* Creatively engages the public in robotics and STEM related topics	
* Showcases their universities progress in the design and build of their robot	
* Motivates and encourages K-12 robotic groups to showcase their robots	
* Educates the public about robotics and the current NASA missions	

On-Site Public Engagement	3 points for 3 elements clearly, 2 points for 2 or less elements clearly and 1 - 0 points for 1 or 0 elements clearly demonstrated.
* Exudes a positive attitude in all interactions	
* Conducts themselves as positive role models	
* Demonstrates courtesy with authority & competitors	
* Decorates team's Pit to reflect school/team spirit	